

## UMLS Linked to a System for Authoring Simulations Used in Evaluation of Physicians

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The National Board of Medical Examiners (NBME) develops examinations used in licensing physicians in the United States. To complement existing multiple-choice examinations, NBME has developed and is studying an uncued, dynamic, computer based simulations (CBX) of the patient care environment [1,2,3]. In CBX, physicians type free-text orders for diagnostic studies, procedures, consultants, medications, and other therapies. As simulated time passes, the patient condition evolves in response to physician management decisions; multiple outcomes are possible. One impediment to widespread use of CBX has been the technical expertise, time, and cost associated with translating knowledge about disease states into CBX patients. A new case authoring system (SEEDS - Simulation Environment Engineering and Development System) will increase the efficiency of this process.

The National Library of Medicine's Unified Medical Language System is used to access CBX case authoring materials [4]. The "Diseases", "Chemical and Drugs", and "Analytic, Diagnostic, and Therapeutic Techniques and Equipment" hierarchies provide convenient means for linking UMLS and CBX terms and concepts. CBX case authoring materials include normal patient information (e.g., diagnostic study and procedure results) for different ages, genders, and conditions; and patient findings, interventions (i.e., medications and other therapies), diagnoses, and cases. Relationships among tests, therapies, cases, and diagnoses have been accumulated over 10 years of NBME CBX development. For instance, given a diagnosis an author can retrieve tests that may be abnormal, therapies that may be effective, or tests and therapies that should be considered. UMLS hierarchies, when incomplete, are complemented with CBX terms.

With SEEDS, CBX cases are constructed using graphical metaphors; details are specified through text entered in superimposed windows. Using these tools and the ability to cut and paste "pieces" of other cases, an author more easily can construct cases that realistically simulate a clinical problem. The NBME

is developing SEEDS for its internal use in the construction of cases for evaluation of physicians. The system will be of interest to others for a variety of potential applications.

SEEDS is being developed under Motif and ULTRIX 4.2A on Digital Equipment Corporation DECstations, and uses the ORACLE database management system. The CBX cases developed using SEEDS will not be limited to running under UNIX.

### References

- [1]. Clyman SG, Orr NA: Status Report on the NBME's computer-based testing. *Academic Medicine* April 1990;65(4):235-241.
- [2]. The National Board of Medical Examiners Computer Based Clinical Simulation (CBX). National Board of Medical Examiners, 1991.
- [3]. Computer Based Examination (CBX) - System Description. National Board of Medical Examiners, 1991.
- [4]. Humphreys BL, Lindberg DA: Building the Unified Medical Language System. In: Kingsland III, LC, ed. *Proceedings of the Thirteenth Annual Symposium on Computer Applications in Medical Care*. Washington, Institute of Electrical and Electronic Engineers, 1989, 475-480.

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